UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

CCS511 – Evolutionary Computing

Duration : 2 hours

INSTRUCTION TO CANDIDATE:

- Please ensure that this examination paper contains **THREE** questions in **THREE** printed pages before you begin the examination.
- Answer **ALL** questions.

1. The Sudoku puzzle consists of a 9 x 9 grid with 3 x 3 blocks for all the 81 cells. Each puzzle, which has a unique solution, has some cells that have already been filled. The objective of the puzzle is to fill in the remaining cells with the numbers 1 through 9 so that the following rules are satisfied:

   - Each horizontal row should contain the numbers 1-9, without repeating any.
   - Each vertical column should contain the numbers 1-9, without repeating any.
   - Each 3 x 3 block should contain the numbers 1-9, without repeating any.

   (a) Provide a representation for the above problem.

   (25/100)

   (b) Provide a suitable fitness function.

   (25/100)

   (c) If this problem is solved using tabu search, what is the content of the recency-based tabu list?

   (25/100)

   (d) Discuss the suitability of solving this problem using ant algorithm.

   (25/100)

2. Assuming you are solving the Sudoku problem (from Question 1) using genetic algorithm.

   (a) Discuss the suitability of applying one-point crossover to the problem.

   (25/100)

   (b) Discuss a suitable mutation for this problem.

   (25/100)

   (c) Will smart initialization benefit this problem?

   (25/100)

   (d) Discuss the suitability of using the island model where each block forms an island.

   (25/100)

3. (a) What are the shortcomings of parameter tuning?

(25/100)

(b) Describe schema theorem and building block hypothesis.

(25/100)

(c) Describe the major differences between genetic algorithm and genetic programming.

(25/100)

(d) Discuss **three (3)** possible implicit measures to maintain diversity in multimodal problems.

(25/100)

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